Introduction to Chat Bot:

Chatbot is an intelligent Human-Computer Interaction which is designed to stimulate conversation with human users. They have become popular due to their independent platform and available to users without any need for installations.

History of Chat Bot:

In 1950, Alan Turing proposed the Turing Test but later in 1966 the first known chatbot Eliza was developed. Its purpose was to return the suer utterances in a form of questions acting as psychotherapist. In 1972, a personality named PARRY was developed which is an improvement over ELIZA. The first computer to be ranked “most human computer” and also awarded the Loebner Prize named ALICE was developed. It is an annual Turing Test. It was based on Artificial Intelligence Markup Language (AIML) and also served as the knowledge building block for chatbots. The SmarterChild chatbot was available via messenger applications in 2001. Also, many chatbots such as Apple Siri, Amazon Alexa, Microsoft Cortana and IBM Watson were introduced and worked as a virtual personal assistant.

Types of Chat Bot:

Diagram

Description automatically generated

Fig 1: Types of chatbots

Chatbots can be classified into two types i.e., Rule based chatbots and AI based chatbots. AI based chatbots require more training and sometimes it even becomes difficult to users to understand they are conversing with, and Rule based chatbots don’t require much training they only provides questions and answers to users.

Menu Based Chatbots: These chatbots are programmed using menus of yes or no questions. These bots provide a list of surveys, and the users response will determine the following round of questions. These chatbots are typically trained using decision tree models.

Language Based Chatbots: These chatbots are widely used today as a tool for language learning and translation purposes. Numerous multilingual chatbots will be available on various social media platforms such as Facebook, messenger etc. Many users are not familiar with the English language, addition of multilingual chatbots will also draw sizable audience. This also helps in attracting multiple visitors to a certain website, thus improving the companies’ profits.

ML Chatbots: It is an AI based chatbot which requires more training and response time. It is a conversational bot just like human. Users need to wait a little longer as it requires processing response time to get response.

Voice Bots: It is mostly useful for specially visualized people as no typing is required. Sometimes bots can struggle to grasp users’ accents.

Keyword Recognition Based Chatbots: It is rule based chatbots that collects the keywords and then process from the queries. Proper output can’t be produced if the bot cannot understand the keyword.

Hybrid Model Chatbots: It is a hybrid of AI and rule based chatbots. It provides personalized as well as interactive outputs for the users as users can switch the way of answering as per their convenience.

Introduction to Chat GPT

Chat GPT is a part of the GPT i.e., Generative Pre trained Transformer which transforms the wide amount of text data into generate human like text. Chat GPT is one of the large language models that can perform NLP (Natural Language Processing) tasks such as text summarization, question answering, machine translation grammatically error correction within a single architecture. This model has demonstrated its potential in different sectors such as machine-human interaction, research, education, business, health and reasoning. It is a successor to Instruct GPT, a framework based on RLHF (Reinforcement Learning from Human Feedback) that allows the model to set with human values and preferences. It improves from LLMs (Large Language models) which are trained text corpora through unsupervised training. Now Chat GPT has gained remarkable attention and interest from many applicants due to its natural response and exceeding potential. (Tu, 6 Apr 202) .

The main objective of Chat GPT is to make the interaction between human and artificial intelligence more natural. Chat GPT provides more advancement over traditional bots found in the market.

History background of Chat GPT

In the computer science community, Artificial Intelligence Generated Content (AIGC) has gained, beyond attention where Chat GPT and DALL-E 2 were introduced by large tech companies. AIGC is the given human instructions using GAI algorithms () that helps to guide and teach the model to complete the task.

Recent AIGC has more sophisticated models for large datasets that use larger foundation model architectures and accesses to extensive computational resources compared to prior works. Similarly, both Chat GPT and DALLE-E 2 were developed by Open AI which can understand and respond to human language and are able to create high quality and unique images from textual descriptions within a few minutes respectively. The framework of GPT-3 maintains the same as GPT-2 but has better generalization ability than GPT-2 in terms of various tasks such as human intent extraction. The pre training data sizes grew from Web text (38GB) to Common Crawl (570GB after filtering) and the foundation model size grew from 1.5B to 175B. [ 8 and 9.] New technologies were being developed with GAI algorithms due to the increase in computational power and data volume that brought many benefits. There are three types of machine learning i.e., supervised learning, unsupervised learning and reinforcement learning.

Open AI initiative was founded by Sam Altman, El’ Musk and others. At the forefront of AI research, he has produced several breakthrough models such as GPT-2, GPT-3 and finally Chat GPT building on the success of GPT-3. Open AI continued to lead the creation with R&D efforts and Chat GPT based on GPT-4 Architecture was introduced.

The evolution of GPT

GPT – 1: This is the first version of GPT released in 2018. A neural network architecture i.e., Transformer architecture was used in this version to do NLP (Natural Language Processing) tasks such as machine translation and language modeling. Its architecture is of 12 level, 12 – headed transformer decoder (no encoder), followed by linear-soft max with Book Corpus: 4.5 GB of Text. It has 117 million parameter count.

GPT - 2: It is the improvised version of GPT -1 with 1.5 billion parameters with greatest parameters at that time. It was released in 2019 with modified normalization with Web Text: 40 GB of text. The notable feature of this version was it can generate coherent and realistic text which is difficult to differentiate from the human-written text. This raised some concerns about possible misuse of this model, such as generation of fake news. This is why Open AI initially decided not to release a full version but released a smaller version.

GPT-3: This was released in 2020 with the modification to allow larger scaling with 570 GB plaintext. With 172 billion parameters, it was the most powerful and largest model ever created. This model’s ability is to perform sentiment analysis, question and answering of NLP. It also includes language translations, chat bots, code generations etc. It has sparked new research and development in the field of open AI.

Other GPTs:

Instruct GPT, ProtGPT2, Bio GPT were other GPTs that were introduced after GPT-3 in 2022 along with Chat GPT. Instruct GPT has same parameter count as GPT-3 but is fine tuned to follow instructions using human feedback model where ProtGPT2, Bio GPT has 738 and 347 million parameters count respectively. ProtGPT2 is built on the GPT2 Transformer architecture and includes 36 layers with a model dimensionality of 1280, making it a powerful model with 738 million parameters. The pre-training of ProtGPT2 was done on the UniRef50 database (version 2021\_04) in a self-supervised manner, using raw protein sequences without any annotation. Whereas Bio GPT is based on TLM (Transfer model architecture) focused on mining and generating biomedical text. And Chat GPT with 175 billion parameters count uses version GPT-3.5 with fine-tuned of both reinforcements learning from human feedback and supervised learning.

GPT- 4:

It is the latest version of GPT with 100 trillion parameters count which is trained with both text prediction, RLHF and accepts both text and images as input as well as from third party. The development of GPT-4 took advantage of lessons learned from the Open AI and Chat GPT adversarial testing programs and made iterative adjustments over a period of six months, resulting in improvements in terms of factuality, controllability, and boundary compliance. Still there is room for improvement.

How Chat GPT works:

The working procedure of Chat GPT can be divided into two types i.e., Query procedure and Response.

An artificially intelligent supercomputer is the device behind the Chat GPT. These computers are trained with numerous parameters on a massive data set which is unsupervised learned by determining the statistical structure within the data to identify the patterns. Usually, users make a Query to Chat GPT. Then that query is sent to the supercomputer and is processed. The probable output is generated by the query generation circuitry and the output data are fine tuned. After this process, Chat GPT is directed to response. Finally, the conversational interface interacts with human and provide human like response in Chat GPT.

Since Chat GPT utilizes the GPT-3.5. The followings are the workflow of GPT 3.5:

1. Collect demonstration data and train a supervised strategy. First, prompts are sampled from the prompt record (dataset). Then demonstrated by labeler with desired output behavior. This data will be used to fine-tune his GPT3 in supervised learning.
2. Collecting comparative data and training reward models. Then the prompt and some model outputs are sampled. Labeler organizes the output from best to worst.
3. Policy optimization for reward models using reinforcement learning.

Finally, new prompts are sampled from the dataset. The policy produces output of a reward model and computer rewards for outputs.

Literature Review:

Chat GPT has the potential to change different sectors such as education, health, business, research and so on. Chat GPT has several educational advantages, but it depends upon individuals about how they use Chat GPT and any other AI tools. Chat GPT provides personalized learning experiences by evaluating a student’s learning methods and preferences and suggesting particular educational materials that are fitted to their requirements. It also improves language skills of individuals. It provides immediate feedback on their grammar, pronunciation, and vocabulary while simulating real-world conversations. It can also be used in grading as it provides feedback on students’ work. Students can use Chat GPT to improve their research skills as it provides answers to their questions.

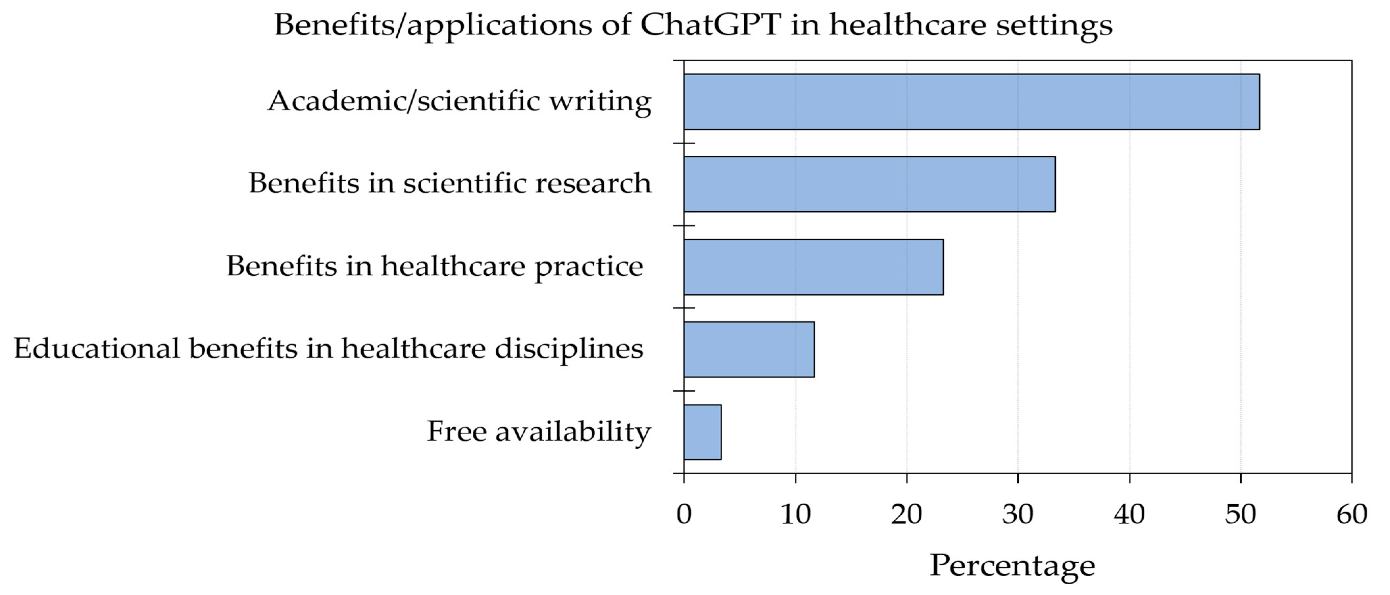


Fig: Benefits of Chat GPT in different sectors

The question-answering features of Chat GPT can also be used in the field of medicine, such as for addressing patient medical inquiries or helping medical professionals identify conditions. By responding in a way that feels natural and real, this may make it simpler for virtual agents to communicate with patients and increase their effectiveness. It may be used to help prioritize symptoms for particular illnesses or to provide general guidance on healthcare requirements. They could also operate as the main point of contact for people seeking mental health care, offering initial consultations, and making appropriate referrals to specialists.

According to the survey for patient-doctor communication from EHR, placing the patient questionnaire in Chat GPT and responds the same number of words as doctor. The survey found that people appear to trust Chat GPT to provide information on low-risk health questions and people tend to trust doctors for complex medical queries. As health-related tasks in the questions became more complex, people’s faith in them diminished.

Chat GPT can be utilized in the business and finance sector. Some of the areas are customer service, market analysis and forecasting, investment management, fraud detection, risk management and financial reporting. It provides product suggestions, asks inquiries from client and proceeds with the transactions. Huge quantities of financial data can be analyzed by Chat GPT to spot patterns and trends and gain insights into market dynamics and trends. It could assist companies and investors in making proficient decisions about investments. Systems that can uncover financial crimes and fraud can be developed using Chat GPT. It can also assist financial organizations stop losses by examining transaction data and spotting patterns that might signify financial behavior.

Chat GPT can also be utilized in scientific research as well. Processing and analyzing massive amounts of data is one of the most important components of scientific research. Chat GPT has significantly changed the method researchers participate with and analyze. This section examines Chat GPT’s numerous data processing and analysis applications, demonstrating how it might completely revolutionize the field. Chat GPT can quickly recognize and extract significant data points, outcomes, and implications from research studies using NLP (Natural Language Processing) algorithms. This helps many researchers to synthesize and gather information from many sources easily and quickly. It also improves the process of doing research efficiency rather than manually reviewing the literature reviews. Chat GPT can help researchers to gain a clear and thorough comprehension of their research and produce practical insights, this helps to summarize complex data fast and accurately. Researchers can gain insights via Chat GPT that might not be immediately evident though human analysis by having it automatically find correlations, anomalies and other relevant relationships within the data Researchers can find new connections, develop fresh theories, and advance science with the aid this computerized pattern recognition. It has the ability to forecast trends and occurrences in the future by examining historic data and locating fundamental patterns. This capacity for prediction can be extremely useful in a variety of scientific fields, such as c epidemiology, economics and climatic science where precise forecasting can help guide evidence-based decision making and support the creation of efficient policies and interventions.

Chat GPT and its pros/cons/limitations

Pros of Chat GPT:

* Chat GPT has the capacity to generate human-like responses. This is useful for language translation and customer service chatbots. Compared to other NLP models Chat GPT’s ability is to generate more human like responses. It produces better experience and satisfaction to users by leading to more meaningful and engaging conversations.
* Chat GPT is known for its scalability. For companies and organizations needing automated customer care or language translation, its scalability makes it the perfect tool. It also minimizes human involvement and boosts effectiveness. Chat GPT can manage numerous chats at once, responses times may be quicker, which will eventually increase customer satisfaction.
* Customizability is another important advantage of Chat GPT. By adjusting its training data and algorithms, it can be fine-tuned to carry out specific tasks and algorithms. It makes Chat GPT a very adaptable and versatile tool, ensuring its responses are customized to the demands of the user. Additionally, customization enables companies and organizations to provide more individualized consumer experiences, ultimately enhancing client pleasure and loyalty.
* Chat GPT is very efficient for users as it generates responses quickly and handles numerous conversations at once. Efficiency is especially important in jobs where human participation may be time-consuming and expensive for e.g., language translation and customer service. Chat GPT may help companies and organizations to increase productivity and profitability while saving time and money.

Cons of Chat GPT:

The potential for bias in Chat GPT’s responses is one of its drawbacks. Since it was trained on a huge body of text data, responses it produces may contain biases and errors. As a result, the training data’s replies from Chat GPT may reinforce prejudice or stereotyping. Careful selection and curation of the training data is necessary to reduce bias, and it is crucial to continuously check Chat GPTs responses for biases and make the necessary corrections.

The fact that Chat GPT requires more emotional intelligence is another drawback. It may find it difficult to understand and react to emotional cues in human communication, such as communication, such as comedy or sarcasm. As a result, Chat GPTs comments may become insensitive or tone-deaf insensitive or tone-deaf or insensitive which may annoy or turn off users. It could be essential to add more code or training data to Chat GPT to help it comprehend and react to emotional cues better to solve this problem.

Limitations of Chat GPT:

As with any language models, Chat GPT is trained using sizable text datasets text datasets that could include biases and prejudices. Because of this, Chat GPT may replicate or exaggerate these biases in its output, which could have adverse effects, particularly in educational contexts were fairness and equity.

Inaccuracy: Chat GPT is not flawless and may make mistakes or produce incorrect results. This is especially true if the input is confusing, vague, or contains mistakes.

Lack of context: Although Chat GPT produces responses based on statistical patterns discovered from a huge body of text, it may not always recognize the context of the input or produce responses that are appropriate for the context.

Limited domain expertise: Due to Chat GPT’s limited domain experience, it’s possible that it won’t be able to produce correct or pertinent answers to questions about specialist subjects.

Ethical issues: Using Chat GPT involves ethical issues, particularly when it comes to education. For instance, it would be deemed plagiarism to use Chat GPT to produce responses for academic assignments without giving due credit and acknowledgement.

Dependence on technology: Chat GPT usage necessitates stable internet connectivity and access to technology, both of which may not be available or inexpensive for many students and teachers.

Evaluation:

Comparison of Chat GPT with other existing AI:

In most cases, Chat GPT performs better than a variety of state of the art zero shot learning large language models, and in some cases, it even surpasses specially tailored task-specific models. We discovered that Chat GPT cannot be used for low-resource languages in terms of linguistic diversity since it lacks the ability to comprehend the language and provide translations for it. Compared to specialist language-visual models, Chat GPT’s multiple mediums capabilities are relatively inadequate.

As a result, Chat GPT has never surpassed the caliber of the top models already in use. According to experimental data, the Chat GPT model has an average quality of just 56.5% compared to the SOTA model’s average quality of 73.7%. In contrast, the performance of Chat GPT’s has 23.3% of standard deviation whereas the standard deviation of SOTA model’s is only 16.7%. This uncertain behavior could have major negative effects in various situations.

Chat GPT works comparable to Bert-style models and GPT-3.5 in terms of analysis of sentiment job. Meanwhile, Chat GPT performs severely on three comparatively subjective emotion perceptions tasks, with losses on the majority of tasks not exceeding 25% according to the literature. The quality method of Chat GPT has a quality of average 69.7% whereas the SOTA approach has an average of 80% when these tasks are taken out of the calculation to determine the average quality of two models.

In other words, Chat GPT excels at all tasks- aside from those that involve emotions and is capable of resolving the majority of the issues we take into account. Based on evidence from experiments, the performance of Chat GPT is often inferior to the SOTA model, but the gap between the two is not very wide.

Chat GPT and its technical implementation:

Recurrent Neural Networks (RNNs) and related variants were used to develop Controversial Model in the beginning such as Long Short-Term Memory Models (LSTMs) when Transformers were not previously used.

To solve the drawbacks of models like RNNs, transformers were invented. Transformers are suited for long-distance dependencies and considerably reduces training time due to its self-attention parallel in nature. Encoders and Decoders are the two parts of transformers. The goal output sequence is processed by the decoder while the input sequence is processed by the encoder. The encoder applies various layers of encoding to the sequence, generating a vector for each token. These vectors depict the relationship between each token and the words that appear before or after it. These vectors are finally stimulated by decoder architecture. The first word as output in accordance with the task was produced by decoder that was given to it which might be language translation or question answers. The first word produced serves as the input for the decoder to create the next word in the sequence in the following stage. In order to produce the finished product, this process is recurred. The Books Corpus dataset which contains more than 7,000 books from various genres, was one of the huge corpora of data used by the researchers to train the model. They learned the starting parameters from this data and adjusted them for a particular supervised task relevant to the target task. With a 12-layer decoder only transformer, the GPT model adheres to the transformer architecture.

Analysis:

Ethical issue on scientific research:

Data security and privacy concerns are becoming increasingly common as AI is more frequently in data processing and analysis. The utmost focus is placed on ensuring the security of private data and the moral use of data. Chat GPT and other AI models are used to train large datasets that could contain prejudicial, preconceptions, and biased language. As an outcome, the model could unknowingly pick up on these prejudices and give answers that are discourteous or promote negative stereotypes. The model’s architecture must be enhanced, and the training data must be improved, and procedures must be put in place to guarantee impartiality and fairness in the outcomes.

Malicious activities including disseminating false information, creating fake news, and masquerading others are all possible with Chat GPT. Addressing these issues is crucial to guarantee that Chat GPT is utilized sensibly and morally. Complex language models such as Chat GPT, can be abused to spread spam, fake news, information content, or engage in online bullying. The danger of illicit use can be decreased by putting in place protections such content screening, user verification and monitoring. In addition, building a strong community of AI developers, researchers, and users who are committed to using AI ethically can be extremely important in inhibiting abuse.

The way mankind connects and communicates with one another may change when AI-generated material becomes ubiquitous. The possible dehumanizing mankind of communication as well as the decline of empathy and real connection in interpersonal relationships are ethically problematic. Also concerns regarding authenticity, integrity, and the possibility of plagiarism may arise when employing AI generated content in journalism or academic and other research. It also raises concerns about individual Autonomy and Agency. Some of the ethical considerations include supporting digital communication practices that stress human connection and promoting responsible use of AI generated materials.

Chat GPT is susceptible to adversarial assaults in which untrustworthy users create inputs on purpose in order to influence the model to produce unpleasant or detrimental outcomes.

Carbon emissions and power consumption can be significantly increased by computer resources as it need to train and run Chat GPT models.

Trust issue:

As Chat GPT gains its strength and popularity, it is crucial to determine the individuals accountable for the acts and judgments made by Chat GPT. This concerns matters like who is responsible for the output produced by the model, who holds the data used to train Chat GPT, and who bears responsibility for any adverse impacts of utilizing Chat GPT.

Since Chat GPT and AI-generated becomes more usable, it possibly dehumanizes mankind of communication as user might be unable or face difficulty to differentiate between human and AI generated. Users might start to doubt the legitimacy or source of the information they encounter online as a result, which can undermine confidence in digital communication.

References:

ChatGPT Utility in Healthcare Education, Research, and Practice: Systematic Review on the Promising Perspectives and Valid Concerns